

# Tools & Frameworks

*College Curriculum*

## NETWORKING CURRICULUM



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# **Networking**



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We wish to thank Networking faculty from across the state of Washington, who generously gave of their time and expertise in a two-day intensive workshop to help generate and review the This report presents the competency-based curriculum developed by the NorthWest Center for Emerging Technologies (NWCET). The curriculum was translated through a “fast-track” development process, using the skill standards for the Networking career cluster published in *Building a Foundation for Tomorrow: Skill Standards for Information Technology* (NWCET, 1999).

This report includes the following:

- **Program Learning Components:** meaningful categories of related skills and knowledge.
- **Learner Program Outcomes:** what the learners must be able to know and demonstrate at the end of the program.
- **Key Competencies:** specific, observable knowledge and skills that support and lead to the program learner outcomes.
- **Sample Activities:** activities or projects that provide a context for learners to acquire technical and foundation skills and knowledge, with associated competencies and suggested assessments.

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## **PROGRAM LEARNING COMPONENTS**

**The Learning Components are meaningful categories of related skills and knowledge that are best taught/learned together and represent logical pieces of curriculum.**

## Program Learning Components

### Technical Components

- Math and Science for Networking
- Network Administration
- Network Architecture
- Network Configuration
- Network Hardware Components
- Network History and Trends
- Network Installation
- Network Maintenance
- Network Monitoring and Optimization
- Network Operating Systems
- Network Operations
- Network Recovery
- Network Security
- Network Software Applications
- Network Standards and Protocols
- Network Terminology and Concepts
- Network Testing and Troubleshooting
- Network Upgrade
- Network Vendors and Products
- Office Software Applications
- Programming

### Foundation Components

- Business Organization and Environment
- Communication (Verbal and Written)
- Continuous Learning
- Customer Relations
- Design
- Operational Impact
- Problem Solving and Analytical Thinking
- Professional Development/ Professionalism
- Project Planning and Organization
- Requirements Analysis
- Research
- Resource Management
- Team Process and Leadership
- Technical Documentation

## **LEARNER PROGRAM OUTCOMES**

**Learner Program Outcomes are statements that support the Learning Components by describing what students must know and be able to do by the end of the program.**

## Technical Learner Program Outcomes

### **Math and Science for Networking** – *Technical Learning Component*

- Explain and apply basic electronics and scientific principles used in networking
- Apply scientific principles to develop cost/benefit analysis and budget estimates
- Apply mathematical reasoning and functions to analyze network performance and solve network problems

### **Network Administration** – *Technical Learning Component*

- Define, set up, and implement group and user accounts based on organizational and usage policies
- Maintain and document administrative procedures for security, resource access, and backup
- Make recommendations and follow procedures for network resource allocation and access, backup and security

### **Network Architecture** – *Technical Learning Component*

- Contribute to the design and implementation of the network architecture based on organizational requirements and constraints
- Gather, analyze, and document customer requirements and organizational constraints as they relate to network architecture
- Compare different network architectures as they apply to specific requirements and constraints

### **Network Configuration** – *Technical Learning Component*

- Research client configuration needs, develop a proposed network configuration and present recommendations
- Implement a proposed configuration plan and test network after implementation
- Compare various configuration strategies to determine appropriate plan for organization and user requirements

### **Network Hardware Components** – *Technical Learning Component*

- Document system components and their performance
- Select and install network components according to system requirements and constraints
- Compare features and functions of components

### **Network History and Trends** – *Technical Learning Component*

- Research past and current technology to identify network trends
- Explain the history and development of network topologies, hardware, and software
- Explain the evolution of network standards and protocols, and their impact on network design

### **Network Installation** – *Technical Learning Component*

- Test and troubleshoot performance of network components during and after installation
- Install network according to design and vendor specifications
- Plan and document component and network installation

## Technical Learner Program Outcomes

### **Network Maintenance** – *Technical Learning Component*

- Develop and implement an effective network maintenance plan and schedule
- Perform maintenance functions following maintenance plan, schedule and procedures
- Maintain, replace, and/or upgrade network hardware and software components according to maintenance plan

### **Network Monitoring and Optimization** – *Technical Learning Component*

- Select and effectively apply system monitoring and optimization tools and methods
- Establish and document baseline performance and make recommendations to management for system optimization

### **Network Operating Systems** – *Technical Learning Component*

- Troubleshoot, maintain, and repair network operating systems
- Install, configure, and document network operating system and software
- Present advantages, limitations, and preferred applications of various network operating systems

### **Network Operations** – *Technical Learning Component*

- Perform the daily operations of a network system
- Evaluate and document network system performance
- Analyze and troubleshoot network problems

### **Network Recovery** – *Technical Learning Component*

- Develop and document disaster recovery plan procedures and train users
- Develop and implement network disaster control, recovery and backup procedures with minimal impact to users
- Make recommendations for disaster recovery procedures and strategies

### **Network Security** – *Technical Learning Component*

- Analyze and apply security policies, requirements, procedures, and tools
- Identify, document, and report security risks to network and make recommendations for security improvement
- Install and update security software and patches, establish firewalls and setup user access

### **Network Software Applications** – *Technical Learning Component*

- Analyze needs of organization and research vendors to identify and obtain appropriate software applications
- Install, configure, upgrade, and document network software applications and recommend procedures to train users
- Monitor and document software performance, troubleshoot software malfunctions and test functionality

### **Network Standards and Protocols** – *Technical Learning Component*

- Explain the importance of standards and protocols in implementing networks
- Identify and implement the appropriate standards and protocols for the network
- Research and monitor industry trends in network standards and protocols

## Technical Learner Program Outcomes

### **Network Terminology and Concepts** – *Technical Learning Component*

- Explain networking concepts and define networking terminology
- Apply concepts and terminology to solve problems in networking

### **Network Testing and Troubleshooting** – *Technical Learning Component*

- Select and use diagnostic tools and equipment to identify and analyze network malfunctions
- Develop, document, and implement testing and troubleshooting procedures in accordance with organization requirements
- Document source of malfunction and solutions implemented

### **Network Upgrade** – *Technical Learning Component*

- Develop and implement an upgrade plan that meets organizational needs
- Perform upgrade installation, test effectiveness and functionality of upgrade, and document results
- Analyze current system and organization requirements to identify system upgrade requirements

### **Network Vendors and Products** – *Technical Learning Component*

- Evaluate and document strengths and limitations of specific vendors, products and services
- Research, select and document vendors, products and services that meet organizational, user and technical support needs

### **Office Software Applications** – *Technical Learning Component*

- Use software applications to analyze and solve business problems, and enhance productivity
- Use software applications to effectively support the business communication process

### **Programming** – *Technical Learning Component*

- Define and document program specifications and program design
- Plan and implement testing and debugging procedures to verify program reliability
- Use programming language statements, functions, variables and control and data structures correctly

## Foundation Learner Program Outcomes

### **Business Organization and Environment** – *Foundation Learning Component*

- Identify and discuss contemporary business principles, practices, and organization
- Present and discuss how computer systems impact the operation and management of business
- Identify and work within an organization's environmental dynamics and constraints

### **Communication (Verbal and Written)** – *Foundation Learning Component*

- Develop and deliver effective oral communications
- Create and adapt effective written communications according to audience and purpose
- Evaluate and select the appropriate written and oral communication strategies and styles for a specific purpose

### **Continuous Learning** – *Foundation Learning Component*

- Evaluate needs for training and education and implement a personal development plan
- Identify and take advantage of learning opportunities to develop skills and knowledge
- Research and maintain current training information from various sources

### **Customer Relations** – *Foundation Learning Component*

- Gather and interpret information to understand customer requirements
- Effectively communicate and interact with customers
- Identify and meet the needs of the customer and the business

### **Design** – *Foundation Learning Component*

- Develop design to meet specifications and present to management for approval
- Evaluate product design, document the specifications, create and test a prototype
- Identify and document the effectiveness of the design and design process, implement solutions, and test for functionality

### **Operational Impact** – *Foundation Learning Component*

- Communicate technology changes to customers and assess the impact on productivity
- Evaluate the impact of management decisions on the technology environment
- Analyze operational and budgetary impact of technology changes

### **Problem Solving and Analytical Thinking** – *Foundation Learning Component*

- Apply analytical thinking to gathering information, designing and testing solutions to a problem, and formulating plans
- Create, test and document resolution processes and solutions
- Select, implement, and evaluate appropriate problem-solving techniques and tools

### **Professional Development/Professionalism** – *Foundation Learning Component*

- Develop and document a commitment to professionalism through the demonstration of professional attitudes and actions
- Create and sustain a professional network to further professional development goals

### **Project Planning and Organization** – *Foundation Learning Component*

- Efficiently organize and monitor project resources and tasks to meet requirements
- Develop a complete & realistic project plan that meets the requirements identified by stakeholders

## Foundation Learner Program Outcomes

### **Requirement Analysis** – *Foundation Learning Component*

- Gather, analyze and document information from relevant sources to develop requirements
- Create, refine and document requirements and present to stakeholders for approval

### **Research** – *Foundation Learning Component*

- Effectively communicate and present research results
- Organize, analyze, and synthesize results of research
- Develop and implement an effective process to gather research data from a variety of sources

### **Resource Management** – *Foundation Learning Component*

- Evaluate project to identify required resources
- Develop and implement an inventory plan to monitor and maintain resources
- Obtain necessary resources and optimize resource usage to meet objectives

### **Team Process and Leadership** – *Foundation Learning Component*

- Select and apply a leadership style that is most effective for the team and the environment
- Work effectively within the team's dynamics to support and further team goals
- Promote and contribute to a team process that supports diversity

### **Technical Documentation** – *Foundation Learning Component*

- Apply appropriate techniques, standards, processes and tools to develop and revise technical documentation
- Create effective technical documentation appropriate to various audiences and purposes

## **KEY COMPETENCIES**

**Key Competencies are specific, observable behaviors, knowledge, abilities and skills that detail and support the Learner Program Outcomes.**

### Math and Science for Networking – *Technical Learning Component*

#### Learner Program Outcomes

- Explain and apply basic electronics and scientific principles used in networking
- Apply scientific principles to develop cost/benefit analysis and budget estimates
- Apply mathematical reasoning and functions to analyze network performance and solve network problems

#### Key Competencies

*Demonstrate the ability to:*

- Explain the difference between a baud per second and a bit per second
- Explain and accurately use basic electrical concepts and terminology such as voltage, current, resistance, impedance, capacitance and inductance
- Identify cable needs and calculate cable length for a network installation project
- Explain the features of electrical components essential to an effective network
- Explain the principles of frequency, amplitude, and phase modulation, and their application in a networking environment
- Perform the conversion between binary, hexadecimal, and decimal numbers
- Explain the advantages and limitations of serial versus parallel communications within a network
- Calculate resistance in series and parallel circuits
- Explain the advantages and limitations of analog versus digital technology as they apply to networks
- Explain the principles of data compression for files on the network
- Explain the difference in properties between alternating current (AC) and direct current (DC)
- Explain the importance of electronics to telecommunications media
- Explain the advantages and limitations of wireless media and cable media
- Calculate the costs and compare the benefits of installing a variety of network topologies
- Produce a budget proposal for a given design using mathematical and statistical tools
- Use a math model to demonstrate the limitations of IP addressing on the network
- Analyze and document error detection and correction processes using scientific processes
- Design and implement procedures to identify parity, stop and start bits on the network
- Define and apply scientific methods to solve network problems
- Define logic gates and perform calculations using Boolean Algebra

## Network Administration – *Technical Learning Component*

### Learner Program Outcomes

- Define, set up & implement group/user accounts based on organizational & usage policies
- Maintain and document administrative procedures for security, resource access & backup
- Make recommendations and follow procedures for network resource allocation and access, backup and security

### Key Competencies

*Demonstrate the ability to:*

- Establish and document dial-in procedures for remote users
- Document and apply security requirements and procedures used to protect the network from malicious tampering or accidental damage
- Establish a process to record technical information and regularly update technical documentation to support reliable network performance
- Determine availability of resources assigned to users to maintain access in accordance with network usage policy
- Disseminate necessary documentation to users to assist them in successfully accessing resources on the network
- Perform and document virus-scanning procedures used to protect the computer system and files from corruption
- Establish, perform and document necessary steps used to successfully implement user backup procedures to avoid data loss
- Access & utilize available resources on the network to effectively manage the system
- Develop & maintain an administrative log to document day-to-day network administrative tasks
- Create processes for administering & controlling access to resources on the network
- Identify and implement share-level and user-level access as needed
- Use proper methods to access software applications on the network
- Develop, implement & maintain procedures that establish user access to the network
- Ensure compliance of network procedures with organization requirements
- Analyze network hierarchy structure; make recommendations for user accounts according to the organization framework
- Establish and document user-friendly login procedures and provide instructions for user access to the network
- Monitor resource sharing & user permissions to maintain network application security
- Assign proper characteristics to network accounts to maintain network security and allow users to perform tasks effectively
- Recommend usage policies that support network security
- Establish group account controls that meet network and organization usage policies
- Establish password authentication, rules and policies to secure the network
- Propose user help-desk access procedures to provide technical assistance and improve customer relations
- Design and implement methods to monitor user accounts
- Set up directories on the network to store user files
- Record and perform steps to set up and modify user accounts on the network according to usage policies

### Network Architecture – *Technical Learning Component*

#### Learner Program Outcomes

- Contribute to the design and implementation of the network architecture based on organizational requirements and constraints
- Gather, analyze, and document customer requirements and organizational constraints as they relate to network architecture
- Compare different network architectures as they apply to specific requirements and constraints

#### Key Competencies

*Demonstrate the ability to:*

- Propose architecture recommendations that meet customer and organization needs
- Identify the advantages and limitations of network connectivity devices to determine the appropriate device for a topology
- Properly design a network wiring schematic to meet the planned architecture
- Assess and present to management the benefits and risks associated with implementation of a specific architecture
- Propose intranet architecture for processing information within a specific organization
- Select, use and document the appropriate connectivity devices needed to expand, optimize and interconnect networks
- Design the physical topology to meet the network architecture requirements
- Design a physical layout for an organized wiring closet
- Design a network architecture using multiple protocol suites to enable communication with other network-connected machines
- Evaluate building structure for proper cabling installation
- Research and apply building and wiring codes to design the physical and logical network topologies
- Develop alternative design for an enterprise network using different architectures
- Analyze & document bandwidth requirements to plan for increased network capacity
- Analyze the effectiveness of various media access control methods for a given set of architecture requirements
- Interview customers to identify network architecture requirements and organizational constraints
- Estimate and document the costs and benefits associated with a planned architecture
- Analyze and document customer and organizational requirements as they relate to network architecture
- Identify, select and document a logical topology to meet system requirements and organizational needs
- Identify the advantages, limitations and applicability of various protocols
- Identify, select and document an appropriate physical topology to meet architecture requirements and organizational needs
- Explain and document the advantages and limitations of various network operating systems to support selection of an operating system
- Design a scalable network that allows users and resources to be easily added without excessive delays or loss in performance
- Discuss the differences between peer-to-peer and client server network architectures

## Network Configuration – Technical Learning Component

### Learner Program Outcomes

- Research client configuration needs, develop a proposed network configuration and present recommendations
- Implement a proposed configuration plan and test network after implementation
- Compare various configuration strategies to determine appropriate plan for organization and user requirements

### Key Competencies

*Demonstrate the ability to:*

- Identify current and anticipated user software application needs and incorporate into network configuration plan
- Develop and implement a test plan for the network system after configuration
- Produce a configuration plan document that outlines network configuration schedule, flowcharts, and project management charts
- Gather and analyze user feedback to determine whether the network configuration meets client requirements
- Develop a proposed network configuration plan to meet client needs
- Present proposed network configuration plan to users in non-technical terms
- Estimate the cable plant needs for future expansion of the system configuration
- Apply network configuration procedures to monitor and maintain network resources
- Implement configuration plan according to system and organization requirements
- Interview users and document requirements to analyze network configuration needs
- Determine future equipment configuration requirements based on network usage trends and growth plan
- Implement appropriate solution to configuration problems and assess the outcome
- Organize tasks and team members to implement the configuration plan
- Assess the effectiveness of the configuration and document areas for improvement
- Determine the impact of a network configuration change on the overall system including system downtime and loss in productivity
- Develop alternative solutions to a given network configuration problem
- Estimate and document the costs and benefits associated with a given network configuration plan
- Evaluate network configuration and its compliance with industry-based standards
- Compare various network configurations to identify the advantages and limitations for each configuration
- Document physical constraints to a given configuration and present to management in non-technical terms

### Network Hardware Components – *Technical Learning Component*

#### Learner Program Outcomes

- Document system components and their performance
- Select and install network components according to system requirements and constraints
- Compare features and functions of components

#### Key Competencies

*Demonstrate the ability to:*

- Recognize the differences between hardware and software problems to determine the appropriate solutions
- Identify & document safety/security issues related to network hardware components
- Identify and document network, media and connectivity devices
- Research & select appropriate types of cables & connectors for network installation
- Identify and document critical traffic bottlenecks in an enterprise network and make recommendations for improved usage procedures and hardware solutions
- Determine the cause of hardware component failure and repair or replace according to vendor guidelines
- Document the repair or replacement of hardware components and notify key personnel of changes to the network
- Research the organization technical requirements and user needs to support the selection of hardware components
- Compare functionality & reliability of hardware products; make recommendations
- Read instructions and install hardware according to specifications
- Develop and implement a maintenance schedule to support the optimal performance of hardware components on the network
- Select and install network hardware components to solve specific problems and document changes to the network
- Document & install hardware components in accordance with organization requirements
- Compare quality of service of various hardware vendors and make recommendations
- Communicate hardware component needs to management; secure approval for installation
- Install network adapter cards & software; verify functionality according to specifications
- Obtain and install driver software updates that enable the system to function properly
- Evaluate effectiveness of hardware implementation procedures for given scenarios
- Identify and interview vendors to research available hardware components and their cost for a given network upgrade
- Make hardware upgrade recommendations to meet network performance requirements
- Develop a feasibility study for a given network upgrade and estimate and document the hardware costs associated with it
- Identify the functions and features of the physical layer of the OSI model to assist in resolving hardware problems
- Evaluate security procedures & policies; propose guidelines to secure workstations/network
- Identify the advantages and limitations of various network media access controls to determine methods appropriate for a given system

## Network History and Trends – *Technical Learning Component*

### Learning Program Outcomes

- Research past and current technology to identify network trends
- Explain the history and development of network topologies, hardware, and software
- Explain the evolution of network standards and protocols, and their impact on network design

### Key Competencies

*Demonstrate the ability to:*

- Explain the evolution of standards and their relevance to the development of an open networking environment
- Compare past and current networking standards and their present impact on data communication
- Present the key technology advances that impacted the evolution of data communication
- Summarize trends in network operating systems
- Research and explain the history, development and challenges of remote LAN access
- Explain the history and trends in media access control methods
- Discuss the basic protocols developed for telegraphy and their importance to the development of networks
- Explain the purpose and importance of standards organizations and their relationships to the technical community
- Research and explain the history and trends in network hardware devices
- Research and explain the history and trends in network architectures
- Present trends in network standards and their potential impact on the industry
- Identify and document the converging technologies and trends that led to current network architectures
- Identify trends in development and use of software applications for networks and discuss their impact on operations
- Evaluate the future capabilities of the Internet and WWW and explain their impact on network design and resources
- Research and compare the various industry-accepted protocols

### Network Installation – *Technical Learning Component*

#### Learner Program Outcomes

- Test and troubleshoot performance of network components during and after installation
- Install network according to design and vendor specifications
- Plan and document component and network installation

#### Key Competencies

*Demonstrate the ability to:*

- Develop and implement a test plan for the network system after installation
- Install network operating system and test for performance
- Select and install the appropriate fault-tolerance devices on a network and test their performance
- Identify network device compatibility problems and develop appropriate solutions
- Utilize appropriate test equipment to measure network performance
- Select hardware devices and document their connectivity requirements
- Prioritize steps of installation and document installation procedures
- Organize tasks and team members to implement the installation plan
- Interpret blueprints to evaluate the feasibility of network installation plan
- Present installation plan to team members and management
- Select and document appropriate media access control methods for a given network installation plan
- Evaluate power requirements and availability to ensure necessary capacity for network
- Evaluate and document HVAC and other environmental constraints in the development of the network installation plan
- Research current industry standards and apply these standards in the installation of the network
- Interpret blueprints and user requirements to identify the appropriate physical location for the server
- Develop and document a plan for the physical security of servers on the network
- Draw sketches of proposed wire runs and assess their compatibility with the network installation plan
- Create an accurate and complete wire list schema from a network installation plan
- Document device installation and configuration of network components on the system
- Evaluate and select appropriate mount outlets for installation of required equipment
- Install server software with minimal impact on user productivity
- Use standard practices to locate and label patch panels
- Select and implement appropriate protocols for installation of the network
- Follow vendor specifications and recommendations when installing network components
- Select and use appropriate tools to install the network components
- Install and configure network interface cards on the network
- Install and configure connectivity devices on the network
- Install client software on workstations with minimal delays or loss in productivity

## Network Maintenance – *Technical Learning Component*

### Learner Program Outcomes

- Develop and implement an effective network maintenance plan and schedule
- Perform maintenance functions following maintenance plan, schedule and procedures
- Maintain, replace, and/or upgrade network hardware and software components according to maintenance plan

### Key Competencies

*Demonstrate the ability to:*

- Prioritize network maintenance service requests according to user requirements and level of impact on users and system
- Promptly address network problems as they are identified through maintenance reports
- Perform assigned network maintenance tasks without supervision
- Select and use appropriate tools to test network operating system components
- Seek & incorporate feedback to develop effective solutions to identified maintenance issues
- Properly use performance and monitoring tools to assess network performance
- Evaluate & document results of maintenance performed to solve specific failures
- Create a network maintenance schedule that regularly assesses performance of network components
- Develop hardware/software maintenance plan to meet user needs & system specifications
- Develop and implement a test plan for checking network system operations after maintenance
- Interpret & update network maintenance reports that document current network performance
- Read and interpret warranty information; document impact on maintenance plan and schedule
- Assess the costs and benefits of repairing versus replacing equipment and make recommendations
- Develop a contingency plan for network failure; propose an effective recovery strategy
- Effectively communicate with end-users and administration to coordinate a maintenance schedule
- Select and coordinate equipment needed to implement a network maintenance plan
- Interview users to determine the effectiveness of maintenance; interpret and document feedback
- Estimate the budgetary impact of network maintenance plan and make recommendations to team and management
- Organize maintenance tasks & team members to follow appropriate maintenance plan
- Identify & document hardware required to maintain and improve network performance
- Accurately fill out warranty forms to guarantee compliance with vendor requirements
- Identify and develop criteria for network maintenance baseline performance
- Install hardware and software components in accordance with maintenance plan
- Effectively use hardware and software tools to identify network media problems
- Identify and obtain appropriate software upgrades, drivers and patches using available vendor resources to maintain system performance
- Research and assess the reliability of network hardware and software components

### Network Monitoring and Optimization – *Technical Learning Component*

#### Learner Program Outcomes

- Select and effectively apply system monitoring and optimization tools and methods
- Establish and document baseline performance and make recommendations to management for system optimization

#### Key Competencies

*Demonstrate the ability to:*

- Select and implement procedures to resolve traffic bottlenecks within the network and document the results
- Evaluate hardware and software malfunctions, prioritize the problems according to importance and propose resolution plan
- Identify changes in network performance and compare against specifications
- Organize tasks and team members to perform optimization of the network
- Implement monitoring procedures from a remote location in accordance with organization procedures
- Recognize the differences between hardware and software problems to identify problem areas accurately
- Analyze network performance trends and synthesize results to determine areas for optimization
- Identify and monitor potential environmental hazards that could impact network performance
- Analyze and summarize collected monitoring data to determine system performance
- Identify monitoring requirements, and develop and document monitoring procedures
- Properly use monitoring tools according to vendor specifications
- Follow industry standards and use appropriate tools to monitor the system
- Interview vendors to determine appropriate monitoring tools for the network
- Gather and analyze data to verify that changes to the network achieved optimization goals
- Create statistical report of problems and solutions with necessary graphs to present to management
- Estimate time and budgetary impacts of optimization and make recommendations to management
- Compare network performance to baseline data to identify problems and optimize system performance
- Develop and implement a comprehensive schedule to optimize and monitor network performance
- Modify monitoring procedures as necessary to support optimal system performance and user productivity
- Install and run monitoring software to optimize network performance
- Identify and document abnormal system performance and implement a solution with minimal disruption to user productivity

## Network Operating Systems – *Technical Learning Component*

### Learner Program Outcomes

- Troubleshoot, maintain, and repair network operating systems
- Install, configure, and document network operating system and software
- Present advantages, limitations, and preferred applications of various network operating systems

### Key Competencies

*Demonstrate the ability to:*

- Install and configure client server software within time and resource constraints
- Install network operating systems in accordance with vendor guidelines and specifications
- Identify and document existing network standards related to operating systems to ensure compliance
- Develop and implement acceptance tests to verify that the operating system is performing according to specifications
- Document network operating system installation procedures and server configuration
- Configure the network operating system to meet user and organization requirements
- Install a network operating system and test its performance
- Develop and implement a directory replication procedure to maintain a master set of directories and files
- Create emergency startup disks and boot procedures to restart the system in case of system failure
- Connect and integrate network users with different operating systems
- Create and interpret system logs to identify problems in the network operating system
- Implement and review appropriate logging procedures and resolve logging errors
- Identify and apply appropriate patches and upgrades to the operating system according to vendor specifications
- Compare network performance to baseline data and identify network operating system problems
- Develop and implement network operating system backup procedures to prevent loss of data
- Determine and implement the most appropriate disk file system based on user and security needs
- Identify and use appropriate tools to test a network operating system
- Follow troubleshooting procedures & utilize diagnostic tools to test operating system
- Document operating system backup procedures and make recommendations for improvement
- Develop procedures for communicating the impact of operating system installation and upgrade plans to users
- Explain and document the advantages and limitations of various network operating systems to support selection of a specific operating system
- Make recommendations for new network operating system installations and/or upgrades to management for approval

### Network Operations – *Technical Learning Component*

#### Learner Program Outcomes

- Perform the daily operations of a network system
- Evaluate and document network system performance
- Analyze and troubleshoot network problems

#### Key Competencies

*Demonstrate the ability to:*

- Implement backup procedures to secure user data and system configurations
- Properly use system measurement techniques including probes, performance and protocol monitoring tools
- Configure and monitor network printers and other peripherals to meet user needs
- Set up file systems and directory structures to support network users
- Select and use server tools to administer the network and document results
- Produce operational reports using network documentation application, word processing and chart programs
- Prepare and present a report of necessary upgrades to enhance hardware and software to meet user requirements and optimize system
- Make recommendations to add and install client workstations to network to enhance system usage
- Utilize documentation and system logs to analyze and solve problems on the network
- Evaluate hardware problems and test the operation of hardware components to verify functionality according to specifications
- Implement and document solutions to problems at the server level
- Implement appropriate procedures to correct problems and document changes to the network
- Perform start up and shut down procedures and evaluate effective system operation
- Evaluate hardware or software malfunctions, prioritize the problems in order of importance and propose resolution strategy
- Contribute to the development and implementation of network security procedures to prevent unauthorized use
- Create a security assessment checklist and implement procedures to assess system security
- Identify and correct connectivity and protocol problems to enhance network performance
- Relate symptoms to different OSI levels to identify problems and enhance network performance
- Evaluate software problems and test the operation of the software to verify functionality according to specifications
- Simulate various problems locally to assess their impact on the network and test solutions

## Network Recovery – *Technical Learning Component*

### Learner Program Outcomes

- Develop and document disaster recovery plan procedures and train users
- Develop and implement network disaster control, recovery and backup procedures with minimal impact to users
- Make recommendations for disaster recovery procedures and strategies

### Key Competencies

*Demonstrate the ability to:*

- Install network components into fault-tolerant configurations to minimize the impact of hardware failure
- Test the network system and generate reports regarding the effectiveness of the recovery process
- Identify and train individuals who will perform backup and recovery operations
- Develop a disaster recovery plan in cooperation with network team and vendors, and present to management for approval
- Apply appropriate fault tolerance methods to the current network to optimize network response
- Present the differences between primary and backup servers and explain their respective roles during disaster recovery
- Develop and document a network recovery plan in accordance with the organization requirements
- Select & install uninterruptible power supply hardware and software to prevent data loss
- Develop & implement an effective network recovery and backup training plan for users
- Effectively reconfigure hardware and software after recovery to reestablish optimal performance
- Choose a disaster recovery plan for a given situation and justify selection
- Analyze and interpret data retrieved from error log files to troubleshoot problem areas
- Create a network recovery disk to protect against data loss
- Utilize software to assist in the analysis of error log files
- Identify and repair network media faults
- Identify specific network media failures and implement an effective recovery process
- Identify & recover from virus and other security-related issues with minimal downtime
- Recognize the differences between hardware and software problems to implement appropriate recovery procedures
- Restore data from tape backup after system failure and document procedures
- Analyze and implement the necessary steps to backup a primary and backup server
- Develop and implement a contingency plan to restore stability to the network after a system failure
- Identify conflicting or erroneous data after a system failure and reconcile with backup
- Restore database integrity after identifying and solving problems on the network
- Document system deficiencies and implement appropriate software patches to improve network reliability
- Follow the recovery implementation plan and procedures, and document activities and results
- Discuss the importance of server synchronization and explain how it affects recovery

### Network Security – *Technical Learning Component*

#### Learner Program Outcomes

- Analyze and apply security policies, requirements, procedures, and tools
- Identify, document, and report security risks to network and make recommendations for security improvement
- Install and update security software and patches, establish firewalls and setup user access

#### Key Competencies

*Demonstrate the ability to:*

- Identify and document secure locations for servers and printer resources on the network
- Evaluate installation procedures and server configurations to prevent system tampering
- Determine and establish appropriate client privilege access levels according to security policies
- Research and document applicable organization security policies and make recommendations to team and management
- Create and implement security logs to monitor usage and unauthorized access
- Identify and document potential password vulnerabilities and make recommendations for improvement
- Establish and document firewalls to protect network against external tampering and unauthorized access
- Research and interpret organizational structure to determine categories of users
- Identify security risks within the current system and make recommendations for improvement
- Plan and implement group and user file/directory permissions and resolve any conflicts
- Create and document user access in accordance with organization requirements
- Identify and document the current network security configurations to establish a baseline
- Select and apply standard testing tools and techniques to verify security configurations
- Analyze the current system to determine if the levels of security meet organization requirements
- Report and discuss findings of system violations with management to determine appropriate response
- Analyze security logs to identify potential risks and security violations
- Schedule and perform periodic security reviews to identify security risks
- Analyze current firewall system to determine if it meets the organization needs and make recommendations for improvement
- Identify and document vulnerabilities in software security and apply appropriate patch
- Install and update virus-scanning programs to secure the system from viruses
- Apply the appropriate security software updates when needed
- Configure and document various user password parameters to establish access rights to company data
- Monitor vendor websites to obtain security patches and upgrades
- Develop and implement procedures for updating virus software and security patches on the system

## Network Software Applications – *Technical Learning Component*

### Learner Program Outcomes

- Analyze needs of organization and research vendors to identify and obtain appropriate software applications
- Install, configure, upgrade, and document network software applications and recommend procedures to train users
- Monitor and document software performance, troubleshoot software malfunctions and test functionality

### Key Competencies

*Demonstrate the ability to:*

- Develop and document troubleshooting procedures to test software applications
- Develop test plan to verify that applications are performing according to specifications
- Select and use diagnostic tools to identify software problems
- Examine the effectiveness and document the performance of current software applications
- Keep informed of new software application releases and make recommendations to management for possible installation/upgrade
- Determine needs and implement server-based and/or client-based applications
- Develop and document a software upgrade schedule and present to management for approval
- Discuss proposed software upgrade schedule with users to determine the impact on productivity
- Interview users and management to determine software needs and document the results
- Research software vendors and effectively download and install necessary software for users
- Research software vendors to identify applications that meet user needs within budgetary constraints
- Address software licensing issues in software implementation plan
- Install software applications and verify functionality according to specifications
- Develop and apply appropriate solutions to identified software problems, and test and document the results
- Configure software to meet needs of management and users and document the results
- Install software applications with minimal impact to user productivity
- Develop spreadsheets or other analysis tools to chart and analyze software application usage
- Contribute to the development of an effective software application training plan for users
- Effectively communicate to users the impact of installation of new software and upgrades on the network

### Network Standards and Protocols – *Technical Learning Component*

#### Learner Program Outcomes

- Explain the importance of standards and protocols in implementing networks
- Identify and implement the appropriate standards and protocols for the network
- Research and monitor industry trends in network standards and protocols

#### Key Competencies

*Demonstrate the ability to:*

- Describe the advantages and limitations of packet switching on the network
- Discuss the evolution of various switching technologies and their significance to communications on the network
- Identify industry-accepted protocols and discuss their major features
- Research and document current standards and assess possible industry trends
- Compare the effectiveness of various server standards to determine appropriate method for network
- Compare the differences between different protocols and discuss their application to LAN and WAN systems
- Define and appropriately use network protocol acronyms and terminology
- Describe the different types of virtual circuits as they relate to specific protocols
- Identify the functions and features of network protocols and their relevance to the OSI model
- Design address schemes in accordance with Internet protocol requirements
- Assess network load balancing requirements and recommend the appropriate protocols
- Identify and select the appropriate multiplexing technology for specific data types
- Discuss the functions and features of Net BIOS Broadcast and its relevance to network standards
- Compare and contrast routing standards to determine the appropriate standard for a specific network
- Research and compare the various industry-accepted protocols and their impact on data communications standards
- Discuss the role of various regulatory agencies in determining standards and protocols
- Compare the differences between uni-cast and multi-cast network traffic and identify impacts on the network
- Discuss the functions and features of gateways and how standards apply to them
- Explain the purpose and importance of standards to the development of an open network environment

## Network Terminology and Concepts – *Technical Learning Component*

### Learner Program Outcomes

- Explain networking concepts and define networking terminology
- Apply concepts and terminology to solve problems in networking

### Key Competencies

*Demonstrate the ability to:*

- Explain the differences between repeaters, bridges, routers, gateways and switches and explain their significance to network communications
- Describe the features and functions of various network communication media
- Explain and compare the different forms of network communications transmission
- Discuss the differences between a client-server network and a peer-to-peer network
- Define and apply the process of "connectionless" packet communication on the network
- Discuss the differences between uni-cast and multi-cast traffic on a network
- Identify and document the features and functions of protocols at each layer of the OSI model
- Explain the functions and features of firewall technology and its importance to the network
- Explain the principles of internetworking and intranetworking, and present the differences between these processes
- Explain the purpose and importance of the OSI model and its impact on network communications
- Define and apply the process of "connection-oriented" packet communication on the network
- Explain the differences between transmission rates and effective throughput in different network topologies
- Discuss the advantages and limitations of various encryption methods for securing the network
- Explain data representation and its relevance to data transmission on the network
- Explain the different data communication functions on the network
- Describe the features of statistical and time-division multi-plexing as related to specific types of data transmission
- Describe the process of packet addressing and the use of routers to modify a network address
- Explain the use of TCP/IP utilities and assess their performance on the network
- Explain the methods available to implement network security in WAN and LAN systems
- Explain and apply the various data compression methods to the network
- Define the term "bandwidth" and discuss its relevance to data transfer capacity on a network

### Network Testing and Troubleshooting – *Technical Learning Component*

#### Learner Program Outcomes

- Select and use diagnostic tools and equipment to identify and analyze network malfunctions
- Develop, document, and implement testing and troubleshooting procedures in accordance with organization requirements
- Document source of malfunction and solutions implemented

#### Key Competencies

*Demonstrate the ability to:*

- Use appropriate console commands to troubleshoot the network
- Select and use standard analysis techniques that support the troubleshooting process
- Utilize console commands to analyze network and troubleshoot problem areas
- Regularly inspect network for potential wire breaks & other physical problems; repair as needed
- Use network protocol and segmenting analysis equipment to analyze the network
- Select and use electric and electronic diagnostic tools to identify problems and malfunctions on the network
- Organize tasks & team members to implement procedures for physical inspection of network
- Identify and resolve router and cable problems with minimal impact to users
- Research & identify industry trends in analysis techniques to enhance troubleshooting procedures
- Apply troubleshooting procedures and utilize diagnostic tools to test the operating system, and repair as needed
- Utilize physical media diagnostic equipment to identify cause of equipment malfunction
- Implement and document procedures to gather user feedback on network problems
- Analyze user feedback and implement appropriate technical support procedures to resolve user problems
- Select and implement usage procedures to resolve traffic bottlenecks within the network and document the results
- Analyze and document the effectiveness of troubleshooting procedures and make recommendations for improvement
- Produce and maintain an inventory schedule for ordering components used to test, troubleshoot, and repair network
- Implement backup procedures before troubleshooting the system to prevent data loss
- Outline and implement troubleshooting procedures and assess their effectiveness
- Research and document alternative testing methods to optimize testing procedures
- Troubleshoot data overload; implement appropriate solution with minimal user impact
- Interview users to assess severity of problem and accurately document communications
- Identify & document symptoms of network malfunctions; develop/implement solutions
- Identify & document source of a power outage; develop/implement solutions
- Propose & discuss with team members troubleshooting procedures to minimize user downtime
- Identify shielding-connection-grounding problems; develop & implement appropriate solutions
- Interpret building blueprints to locate problem components identified during testing & troubleshooting

## Network Upgrade – *Technical Learning Component*

### Learner Program Outcomes

- Develop and implement an upgrade plan that meets organizational needs
- Perform upgrade installation, test effectiveness and functionality of upgrade, and document results
- Analyze current system and organization requirements to identify system upgrade requirements

### Key Competencies

*Demonstrate the ability to:*

- Determine and document hardware and software required to meet upgrade objectives and present to team and management for approval
- Develop and document upgrade plan according to the organization requirements
- Prioritize and document tasks to implement upgrade plan according to the organization time constraints
- Estimate and document the costs and benefits associated with network upgrade
- Assess organization and user needs to identify upgrade requirements and make recommendations to management
- Identify and interview vendor sources to determine the appropriateness and availability of components needed to perform upgrade
- Develop procedures to implement upgrade support to users
- Organize tasks and team members to provide upgrade support to users
- Develop and implement procedures to verify functionality of workstation and server connectivity after upgrade
- Develop a feasibility study to assess the effectiveness of proposed network upgrades
- Develop and document baseline performance to measure effectiveness of upgrades
- Develop and implement procedures to verify effectiveness of upgrade configuration changes
- Perform user acceptance tests after the upgrade is complete and document the results
- Install upgrade equipment and software according to vendor specifications and document changes to the network
- Select and install hardware components and software to upgrade the system and optimize system performance
- Evaluate the effectiveness of different architecture upgrades and make recommendations to management
- Interview vendors to identify emerging technologies and make recommendations to management for future upgrades to the network
- Develop and propose an upgraded network design to resolve system limitations
- Analyze and document performance of the existing network to identify system limitations
- Interview users and evaluate input to determine if upgrade needs are perceived or actual
- Identify and document network bottlenecks to determine areas for upgrade and make recommendations to management

### Network Vendors and Products – *Technical Learning Component*

#### Learner Program Outcomes

- Evaluate and document strengths and limitations of specific vendors, products and services
- Research, select and document vendors, products and services that meet organizational, user and technical support needs

#### Key Competencies

*Demonstrate the ability to:*

- Document the products installed on the system and document their respective vendors
- Interview vendors to obtain and document equipment costs for a given network upgrade
- Interview vendors to determine appropriate monitoring tools for system requirements and resource constraints
- Interview users to identify and evaluate problems and determine appropriate solutions
- Interview vendors to obtain vendor, product and service information relevant to the organization system requirements
- Evaluate and document the advantages and limitations of various vendors' software products
- Evaluate and document strengths and weaknesses of various vendors' hardware components
- Develop a plan for multi-vendor installation and make recommendations to management for approval
- Identify and select vendor products that meet system requirements
- Install software and hardware according to vendor specifications
- Identify vendor, product and service alternatives to resolve network problems and make recommendations
- Evaluate trends in network vendors and products to plan for future network support and growth
- Research and compare various vendor service policies to determine their compatibility with the organization
- Assess and document vendor goals and strategies to determine their compatibility with the organization requirements and culture
- Regularly update vendor and product information
- Research and organize vendor and product information for easy access
- Interview management to determine and identify expectations in vendor relationships
- Estimate and document the costs and benefits of alternative vendor and product solutions

## Office Software Applications – *Technical Learning Component*

### Learner Program Outcomes

- Use software applications to analyze and solve business problems, and enhance productivity
- Use software applications to effectively support the business communication process

### Key Competencies

*Demonstrate the ability to:*

- Use the basic functions and tools of email applications
- Use email effectively and appropriately in business communication
- Present the basic components and organization of email systems
- Use email system support help facilities and advanced email tools
- Use the Internet as a research tool in an efficient manner
- Use the basic functions and tools of Internet applications
- Import text and images from Web pages into office applications
- Use basic word processing skills, such as document formatting, editing and using tables
- Create simple word processing documents such as letters, memos and basic reports
- Create compound documents, such as newsletters with graphics and objects from multiple software applications
- Design, create, modify and troubleshoot simple spreadsheets
- Create graphs and charts in spreadsheets
- Apply spreadsheet principles and tools to solve business problems
- Use the basic functions and tools of presentation software applications
- Use the components of presentation software creatively and effectively to create and deliver presentations
- Define and use the basic terminology of relational databases
- Design, create, modify and troubleshoot simple relational databases
- Design, create, modify and troubleshoot simple database queries and reports
- Apply database principles and tools to solve business problems
- Establish different levels of user access for reading and entering data into a database
- Import and export data and objects between different applications
- Effectively use online help to solve software application problems or learn new functions

### **Programming – Technical Learning Component**

#### **Learner Program Outcomes**

- Define and document program specifications and program design
- Plan and implement testing and debugging procedures to verify program reliability
- Use programming language statements, functions, variables and control and data structures correctly

#### **Key Competencies**

*Demonstrate the ability to:*

- Write correct loop structures and use appropriately
- Perform cost/benefit analysis to determine program features that can be easily and inexpensively added and document recommendations
- Establish, implement, and document procedures to verify functionality of a program according to specifications
- Use correct data type specifications to define a data set and range of values
- Design user interface specifications that support user customization and productivity
- Produce program structure using appropriate programming standards and practices
- Design and implement programs using external files and access methods
- Create program design that effectively addresses user needs
- Document usability testing procedures and results
- Implement debugging procedures in a systematic and effective manner
- Analyze, design, and document solutions to programming problems
- Use debugging tools to identify and fix code and structure problems
- Develop and implement a testing plan to verify program reliability
- Perform usability testing, analyze results and make recommendation for program design change
- Design and write programs that are syntactically correct
- Translate formulas into computer statements, and apply correct arithmetic and logic operations
- Define and correctly scope programming variables according to specifications
- Appropriately use logic statements, data arrays and record structures when writing code
- Develop program structure using one or more programming languages
- Define and apply correct input and output specifications for a given problem statement
- Create and correctly apply subroutines, functions and modules

**Business Organization and Environment – *Foundation Learning Component***

**Learner Program Outcomes**

- Identify and discuss contemporary business principles, practices, and organization
- Present and discuss how computer systems impact the operation and the management of business
- Identify and work within an organization's environmental dynamics and constraints

**Key Competencies**

*Demonstrate the ability to:*

- Discuss the concepts and issues of human resource management
- Identify and discuss intellectual property issues in business and possible resolutions
- Explain the concepts and issues of marketing products and services in a given market
- Discuss the legal and social aspects of the business environment
- Define and appropriately use general business terminology
- Identify and discuss the issues specific to corporations conducting business internationally
- Identify and discuss the main differences between small business environments and mid-to-large business environments
- Discuss the importance of management's commitment to organizational growth and change
- Discuss the concepts and issues of business management
- Identify and discuss the benefits and limitations of the use of virtual offices for business
- Identify and discuss the impact of political and budgetary constraints on the decision making process within an organization
- Identify and discuss internal and external factors that may affect an organization's ability to grow and change
- Discuss the benefits of the Internet for business growth and development
- Identify and discuss ethical issues as they relate to the use of computers and information in today's society
- Research e-commerce to identify its benefits and risks to business in a specific environment
- Discuss the issues influencing the selection of a computer system for a specific environment
- Discuss and describe how a network can support business objectives and goals
- Explain how information systems are used and how they impact specific areas of business operation
- Identify and discuss interpersonal skills appropriate to interacting with co-workers
- Present business problems and clearly articulate possible solutions
- Identify the organization culture and how to successfully work within it
- Create a clear and concise mission statement for a given organization
- Read and interpret organization charts to determine an organization's hierarchy and structure

## Communication (Verbal and Written) – *Foundation Learning Component*

### Learner Program Outcomes

- Develop and deliver effective oral communications
- Create and adapt effective written communications according to audience and purpose
- Evaluate and select the appropriate written and oral communication strategies and styles for a specific purpose

### Key Competencies

*Demonstrate the ability to:*

- Use clear, specific and grammatically correct language in written and oral communication
- Recognize and appropriately address audience focus, level of expertise and need for detail
- Ask relevant and clarifying questions, and listen effectively for content and underlying issues
- Use the appropriate balance of information and personal interpretation in reports and presentations to achieve the intended purpose
- Explain the purpose and uses of written and oral communication in business and industry and give examples
- Be responsive to an audience, and adjust communication format and content accordingly
- Use precise and accurate technical terminology in written and oral communication
- Communicate effectively with audiences with various degrees of expertise in a wide range of technical and business contexts
- Be courteous and professional when communicating with others using a degree of formality appropriate to the situation
- Prepare and deliver professional presentations that are appropriate to purpose and intended audience
- Evaluate effectiveness of presentation by observing the audience and asking for feedback
- Effectively identify and resolve conflicts in communication
- Project a positive attitude and message when unforeseen problems arise during a formal presentation
- Analyze written communication to effectively extract content and underlying issues
- Present information persuasively and sustain an argument using appropriate evidence or examples
- Compose and present well-organized written and oral communication
- Sustain a definite focus and link ideas in a progressive and logical sequence
- Identify, prepare and use the appropriate written communication format for a specific purpose and situation

### **Continuous Learning** – *Foundation Learning Component*

#### **Learner Program Outcomes**

- Evaluate needs for training and education and implement a personal development plan
- Identify and take advantage of learning opportunities to develop skills and knowledge
- Research and maintain current training information from various sources

#### **Key Competencies**

*Demonstrate the ability to:*

- Locate and identify online training and education resources
- Explain the importance of continuous learning in a technology environment
- Research, develop and maintain a library of relevant, current training resources
- Select and join appropriate user groups to discuss new technologies
- Select and read periodicals in related fields to continually improve one's knowledge base
- Research and analyze information from multiple resources to understand available training options
- Develop and document a personal training and education plan
- Assess one's own readiness for further training
- Evaluate effectiveness of training based on changes in performance
- Identify industry trends to assess one's needs for future training
- Implement a personal training and education plan and evaluate its effectiveness
- Identify one's own learning style and preferences in acquiring information and skills
- Share and acquire knowledge from others to compile multiple viewpoints
- Identify opportunities to continue education in related fields
- Take advantage of on-the-job self-learning opportunities
- Identify and use internet tutorials for self-learning
- Select and attend education forums that best meet training needs

### Customer Relations – *Foundation Learning Component*

#### Learner Program Outcomes

- Gather and interpret information to understand customer requirements
- Effectively communicate and interact with customers
- Identify and meet the needs of the customer and the business

#### Key Competencies

*Demonstrate the ability to:*

- Communicate product features and services to the customer in a clear and accessible manner
- Ask appropriate questions to solicit meaningful input from customers
- Communicate administrative policies to customers and explain their importance to business operations
- Explain the importance of customer satisfaction to business operations
- Accept responsibility for one's own behavior and recognize its impact on others
- Recognize and interact with customers at their level of knowledge
- Listen to customer input and interpret feedback to ensure understanding of customer concerns
- Act as a liaison between technical groups to coordinate delivery of product or service
- Explain technical principles to non-technical customers
- Provide guidelines to customers with appropriate level of detail
- Deliver solutions that meet customer needs in a timely and appropriate manner
- Communicate product and service alternatives and options to the customer
- Follow up with customers to evaluate the effectiveness of service over time
- Assess the effectiveness of the customer interaction process and develop recommendations for improvement
- Educate customers on technology trends to obtain customer approval for change
- Analyze customer's technical abilities to determine experience and knowledge base
- Identify customer concerns and resolve conflicts to customer satisfaction
- Solicit feedback from customers and apply input to improve quality of service
- Evaluate and interpret customer requests to differentiate between requirements and desires
- Document customer needs and concerns according to organization procedures
- Conduct interviews with customers to assess needs
- Develop interviewing techniques to assess customer needs and concerns

### Design – *Foundation Learning Component*

#### Learner Program Outcomes

- Develop design to meet specifications and present to management for approval
- Evaluate product design, document the specifications, create and test a prototype
- Identify and document the effectiveness of the design and design process, implement solutions, and test for functionality

#### Key Competencies

*Demonstrate the ability to:*

- Assess a design to identify required materials and resources
- Develop a design that incorporates scalability requirements
- Research and apply appropriate industry standards to design plan
- Select and use appropriate analysis and design tools
- Create a design within a given physical location and set of environmental constraints
- Create concise and accurate design documentation to present to management
- Create a design within given time and budgetary constraints
- Develop and document a strategic plan for implementation of a design
- Evaluate product design for ease of assembly and/or manufacturing
- Read blueprints to accurately identify the physical location of a proposed network project
- Create a prototype to be congruent with scope of project and to meet overall customer requirements
- Assess effectiveness of prototype and make recommendations for improvement
- Test and assess a design to determine if it meets identified specifications
- Create an accurate physical layout and wiring diagram of a design
- Develop and document design evaluation procedures
- Evaluate the prototype development processes and procedures and make recommendations for improvement
- Evaluate and document functionality of the design after implementation and make recommendations for improvement
- Accurately incorporate change orders into a design plan according to the organization's procedures
- Identify and evaluate a variety of analysis and design tools appropriate to the project
- Evaluate the design processes and procedures and make recommendations for improvement
- Compare a design with client requirements to identify differences and document the findings
- Implement and document solutions to improve design

## Operational Impact – *Foundation Learning Component*

### Learner Program Outcomes

- Communicate technology changes to customers and assess the impact on productivity
- Evaluate the impact of management decisions on the technology environment
- Analyze operational and budgetary impact of technology changes

### Key Competencies

*Demonstrate the ability to:*

- Discuss industry regulations and their impact on management's technology decisions
- Evaluate business constraints on technology improvements
- Develop a plan to meet management's technology requirements
- Prepare a budget for technology improvements and present to management
- Establish baseline performance for technology improvements
- Calculate expected costs and productivity benefits of recommended technology changes
- Identify potential product and service limitations and the impact on productivity
- Assess the impact of technology changes on daily business operations
- Identify the personnel and associated costs required to implement a technology improvement plan
- Identify potential environmental risks and their impact on the network and overall productivity
- Recognize a wide range of problems and assess their impact on the system
- Estimate and report the costs associated with technology training
- Develop and implement a process to solicit user feedback and concerns regarding system changes
- Interpret and respond to user needs and concerns regarding technology changes
- Evaluate problems and implement solutions with minimal impact on users
- Evaluate the impact of technology failures on business operations
- Develop a project plan to implement technology changes and determine impact on users
- Communicate to management and personnel the importance of technology improvements to business operations

**Problem Solving and Analytical Thinking** – *Foundation Learning Component*

**Learner Program Outcomes**

- Apply analytical thinking to gathering information, designing and testing solutions to a problem, and formulating plans
- Create, test and document resolution processes and solutions
- Select, implement, and evaluate appropriate problem-solving techniques and tools

**Key Competencies**

*Demonstrate the ability to:*

- Communicate and implement solutions in a manner that minimizes risk and disruption to productivity
- Document technical procedures used to troubleshoot the system
- Evaluate effectiveness of processes, tools and communications used in problem resolution and make recommendations for improvement
- Select and use a wide range of tools and troubleshooting methods to isolate and resolve the problem
- Identify, develop and test a range of potential solutions to a given problem
- Document and communicate problem, analysis and resolution process
- Document and communicate the implemented solution and its outcome
- Examine a complex problem, its elements and their relationships to identify possible causes
- Diagram a given problem in order to facilitate the development of solutions
- Read and interpret technical documentation to analyze problem
- Perform systematic analysis and apply logic to identify problem causes
- Sustain a consistent and systematic approach in analyzing and solving complex, multi-step problems
- Formulate a logical resolution plan based on proposed solutions and available resources
- Recognize a wide range of problems and assess their impact on the system
- Formulate and ask appropriate questions and closely listen to input to identify the problem and possible causes
- Discuss problem causes and resolutions with users and management to develop procedures for prevention of problem recurrence
- Develop a solution implementation strategy and document and communicate the implementation plan
- Assess the cost/benefit of implementing specific solutions and make recommendations
- Identify the potential risks of implementing a specific solution and assess the risks and benefits of alternate solutions
- Monitor the implementation process and readjust, when necessary, to meet goals
- Follow up after a problem has been resolved to verify system performance and user satisfaction

### **Professional Development/Professionalism – *Foundation Learning Component***

#### **Learner Program Outcomes**

- Develop and document a commitment to professionalism through the demonstration of professional attitudes and actions
- Create and sustain a professional network to further professional development goals

#### **Key Competencies**

*Demonstrate the ability to:*

- Obtain relevant professional certifications to increase marketability
- Adapt or expand one's professional network to further or achieve goals
- Identify and attend professional organization meetings to learn from others
- Evaluate portability of skills and develop goals for enhancing and acquiring skills and knowledge
- Create and maintain a professional network
- Analyze the job market to anticipate needs for new skills and knowledge
- Display a positive attitude and foster a productive environment
- Evaluate personal goals and assess accomplishments
- Build upon one's strengths to effectively perform job responsibilities
- Identify employer expectations regarding job performance and attitudes
- Seek and use feedback on personal performance from a wide range of sources
- Develop personal strategies to improve on-the-job performance
- Present oneself in a professional manner

## Project Planning and Organization – *Foundation Learning Component*

### Learner Program Outcomes

- Efficiently organize and monitor project resources and tasks to meet requirements
- Develop a complete and realistic project plan that meets the requirements identified by stakeholders

### Key Competencies

*Demonstrate the ability to:*

- Explain the principles of planning a project and identify critical elements of a successful plan
- Discuss and evaluate project requirements to identify conflicting or overlapping requirements
- Estimate and document realistic time requirements for each phase of the project and present for approval
- Identify and use software tools to support the planning process and create the project plan
- Refine and finalize plan based on available resources and time
- Assign project tasks to team members according to individual strengths and limitations
- Effectively organize and implement a project plan according to requirements identified by stakeholders
- Create and implement an evaluation plan to assess effectiveness and need for improvement
- Define roles and responsibilities of team members within a project
- Assess current team skills and identify the need for outside resources
- Select and use appropriate flowcharting tools to represent project flow
- Develop alternative plans for a given project and select the best alternative to fit project requirements
- Identify and resolve conflicts that arise during the planning and organization of the project
- Organize resources to most effectively accomplish the project tasks within the identified schedule and budget
- Develop a project flowchart to identify tasks and critical decision points
- Accurately identify and document project interdependencies
- Develop and document a detailed project plan identifying the scope and specific tasks
- Identify checkpoints at critical steps in the project to obtain progress reports from team members
- Communicate project plan to team members and solicit feedback to refine the plan
- Evaluate factors that may negatively impact the project and present recommendations to stakeholders
- Develop a project status report and present to stakeholders
- Schedule review dates to support completion of project and present the schedule to team members

### Requirement Analysis – *Foundation Learning Component*

#### Learner Program Outcomes

- Gather, analyze and document information from relevant sources to develop requirements
- Create, refine and document requirements and present to stakeholders for approval

#### Key Competencies

*Demonstrate the ability to:*

- Access reliable and current sources to develop and refine requirements
- Identify missing information within requirements and locate relevant information
- Identify and document risks, constraints and dependencies in requirements
- Gather current and reliable data on a continuous basis to identify changes in customer requirements
- Apply appropriate information and data analysis techniques to interpret and evaluate requirements
- Clearly define and document the priority needs of the customer
- Assess requirement analysis procedures and make recommendations for improvement
- Identify and obtain outsource requirements according to the organization policies and procedures
- Analyze and resolve areas of conflict in specifications and requirements
- Develop and document procedures used to analyze customer requirements
- Gather relevant data in a cost effective and timely manner
- Communicate the complete set of requirements to stakeholders for validation and approval
- Document a final set of requirements in an accurate, complete, and succinct form
- Translate customer requirements into functional requirements
- Identify key stakeholders to contribute to the development of requirements
- Discuss and refine requirements with stakeholders

### Research – *Foundation Learning Component*

#### Learner Program Outcomes

- Effectively communicate and present research results
- Organize, analyze, and synthesize results of research
- Develop and implement an effective process to gather research data from a variety of sources

#### Key Competencies

*Demonstrate the ability to:*

- Analyze and synthesize different points of view on a given research topic
- Analyze research results for completeness and accuracy
- Identify resources that are appropriate for the topic and scope of work
- Identify and resolve conflicts between information from different sources
- Analyze gathered research information for relevance to research topic
- Use various industry journals to gather research information specific to the topic
- Describe ethical considerations related to copyright guidelines and appropriately apply guidelines to research project
- Present the advantages and limitations of different research processes
- Select and use a systematic method to obtain information specific to research topic
- Contact and interview business leaders, community leaders and advisory committees to obtain research information
- Identify and interview appropriate vendors to obtain information specific to research topic
- Document and implement a research process to meet project goals and objectives
- Select and use various Internet search techniques and tools to locate information
- Analyze and evaluate the effectiveness of different research tools and sources based on research goals
- Use library resources to research a specific topic
- Present research results at audience's level of understanding
- Effectively represent research results using appropriate graphics
- Accurately document references used for research material
- Reformat research and summary findings for different purposes and audiences
- Present research results in appropriate format and language
- Obtain and document permission granted for use of copyright material
- Summarize research results in an organized manner and present to stakeholders

### **Resource Management** – *Foundation Learning Component*

#### **Learner Program Outcomes**

- Evaluate project to identify required resources
- Develop and implement an inventory plan to monitor and maintain resources
- Obtain necessary resources and optimize resource usage to meet objectives

#### **Key Competencies**

*Demonstrate the ability to:*

- Optimize the usage of resources to meet the project needs
- Discuss the concepts and issues of human resource management
- Gather and evaluate project requirements to identify necessary resources
- Evaluate costs and benefits of resource allocations and make recommendations
- Assess resource management procedures to determine effectiveness and make recommendations for improvement
- Secure and allocate relevant resources to meet project goals and accomplish project tasks
- Create a resource inventory plan to monitor and maintain technical resources
- Develop and optimize data collection procedures to track resources
- Develop stock level monitoring procedures and present to management for approval
- Propose policies for administering and controlling access to resources
- Assess resource inventory plan to determine effectiveness and make recommendations for improvement
- Develop and implement the resource management plan according to organizational requirements
- Track usage of resources to identify their availability and their applicability to the project
- Assess the impact of future plans on use and availability of resources
- Interact with vendors to obtain resources
- Identify critical checkpoints to verify that resources are being managed and utilized properly
- Develop procedures that increase the efficiency of resource management

## Team Process and Leadership – *Foundation Learning Component*

### Learner Program Outcomes

- Select and apply a leadership style that is most effective for the team and the environment
- Work effectively within the team's dynamics to support and further team goals
- Promote and contribute to a team process that supports diversity

### Key Competencies

*Demonstrate the ability to:*

- Use a leadership style that supports team members freely disclosing ideas and opinions
- Compare various leadership styles and identify appropriate style for a given situation
- Recognize and respect differences in backgrounds, opinions and communication styles of team members
- Share information with others in a collaborative environment
- Support and assist team members to reach their goals and objectives
- Reply to team member requests in a timely and respectful manner
- Organize and facilitate the team process to meet goals and objectives
- Discuss the issues encountered in a diverse organization and identify effective strategies to address these issues
- Coordinate and delegate tasks according to strengths and limitations of team members
- Use appropriate interactive styles and strategies with team members
- Request assistance from team members when needed to perform tasks and reach goals
- Actively support productive ideas and processes to further team goals
- Appropriately resolve conflicts between team members to accomplish team goals and objectives
- Recognize and leverage strengths in self and others to further goals of the team
- Discuss the roles and responsibilities for individual team members in a given project
- Identify, discuss and document procedures used to reach team consensus
- Assess the effectiveness of the team process in a given context and make recommendations for improvement
- Discuss the overall benefits of diversity within a team

## Technical Documentation – *Foundation Learning Component*

### Learner Program Outcomes

- Apply appropriate techniques, standards, processes and tools to develop and revise technical documentation
- Create effective technical documentation appropriate to various audiences and purposes

### Key Competencies

*Demonstrate the ability to:*

- Assess the system repository for effectiveness and usability
- Explain the purpose of various forms of technical documentation
- Evaluate effectiveness of different technical documentation processes and make recommendations for improvement
- Adapt technical documentation to the requirements of the project and the organization
- Select and use appropriate word processing, drawing software and presentation tools to create and update technical documentation
- Plot and diagram data in visual formats appropriate to the project
- Establish processes to record and regularly update technical information
- Effectively organize the data in the systems repository to meet user needs
- Use industry-based technical documentation processes, standards and techniques
- Maintain and track source technical documents according to organization requirements
- Correctly complete work and part orders according to organization requirements
- Create a wiring diagram and label the wiring and naming schemes according to a documented design
- Regularly update documentation through all phases of a systems life cycle
- Accurately update activity log data on a regular basis
- Document design changes using an appropriate documentation process
- Prepare written materials to convey specific technical problems, related issues and solutions
- Accurately identify and record system specifications
- Present technical documentation to the client with an appropriate level of technical complexity
- Create and use appropriate online documentation
- Accurately update the system service log on a regular basis to document performance

## **SAMPLE ACTIVITIES**

- **Activity**
- **Suggested Assessments for Activity**
- **Primary Program Outcomes Addressed by Activity**

**The Learning Activities integrate the technical and foundation Program Competencies.**

## Activity 1 -- Network Administration

Utilizing an existing server with an installed network operating system, a team of students will demonstrate successful login and access to network resources with appropriate security by accomplishing the following tasks:

- Determine user group needs (access to appropriate network resources) by interviewing users
- Ascertain organizational policy and security as it relates to resource access by interviewing management or researching current policies
- Document findings based on interviews with users and management
- Prepare plan for user group organization and access, and present to management for validation
- Set up user groups on the network server
- Make resources available for group use with proper access and security
- Add appropriate users to groups
- Test operations of logins and user access
- Develop presentation (training) to educate users
- Communicate to users their login names, functional workgroups, password and usage policies
- Update existing administration logs showing changes made to server
- Update technical documentation to show changes made to existing network configuration
- Assess whether written network usage policies are appropriate to organization and user needs, including password policies, help desk access, and security requirements

### **Deliverables:**

- Report documenting findings based on interviews with users and management
- Presentation to management on proposal for user group organization and access
- Step-by-step procedures for users outlining login names and passwords and process for accessing network resources
- Log of problems encountered with user access, and solutions implemented to resolve problems
- Updated technical logs
- Report assessing effectiveness of communication process, technical procedures and written usage policies

### **Suggested Assessments:**

- Review reports and documentation for organization, accuracy and clarity of communication
- Review interview process for quality and efficiency, and effectiveness of analysis of survey input and conclusions
- Evaluate presentation to management for thoroughness, clarity and persuasiveness
- Evaluate step-by-step procedures for completeness, clarity, and ease of use
- Evaluate problem/solution log to determine if effective problem-solving processes were used

- Review report to determine whether an appropriate assessment of effectiveness of process and procedures was completed
- Feedback from users on effectiveness of training and effectiveness of overall access to network resources

**Primary Program Outcomes Addressed by Activity:**

*Business Organization and Environment*

- Identify and work within an organization's environmental dynamics and constraints

*Communication (Verbal and Written)*

- Develop and deliver effective oral communications
- Create and adapt effective written communications according to audience and purpose

*Customer Relations*

- Gather and interpret information to understand customer requirements
- Effectively communicate and interact with customers
- Identify and meet the needs of the customer and the business

*Design*

- Develop design to meet specifications and present to management for approval
- Identify and document the effectiveness of the design and design process, implement solutions, and test for functionality

*Operational Impact*

- Communicate technology changes to customers and assess the impact on productivity

*Problem Solving and Analytical Thinking*

- Apply analytical thinking to gathering information, designing and testing solutions to a problem, and formulating plans
- Create, test and document resolution processes and solutions
- Select, implement, and evaluate appropriate problem-solving techniques and tools

*Requirement Analysis*

- Gather, analyze and document information from relevant sources to develop requirements

*Team Process and Leadership*

- Work effectively within the team's dynamics to support and further team goals
- Promote and contribute to a team process that supports diversity

*Technical Documentation*

- Apply appropriate techniques, standards, processes and tools to develop and revise technical documentation
- Create effective technical documentation appropriate to various audiences and purposes

### *Network Administration*

- Define, set up, and implement group and user accounts based on organizational and usage policies
- Maintain and document administrative procedures for security, resource access, and backup
- Make recommendations and follow procedures for network resource allocation and access, backup and security

### *Network Architecture*

- Contribute to the design and implementation of the network architecture based on organizational requirements and constraints
- Gather, analyze, and document customer requirements and organizational constraints as they relate to network architecture

### *Network Security*

- Analyze and apply security policies, requirements, procedures, and tools
- Identify, document, and report security risks to network and make recommendations for security improvement

## Activity 2 -- Network Upgrade

Given specific organization's business structure, objectives, hardware equipment and software, teams of students are asked to:

- Analyze network needs based on business requirements and constraints
- Develop possible configurations with associated cost/benefit analysis
- Develop plan for network upgrade including, hardware, software, and logistics
- Assess potential problems and develop contingency plans
- Assess impact of upgrade on operations and propose appropriate support and training
- Submit report defining current situation, recommended changes, and impact of upgrade to current operations

### **Based on their findings, students will:**

- Research vendors and products available to accomplish the upgrade
- Prepare and deliver a presentation to management (made of other students and/or faculty) outlining proposed changes based on analysis of requirements, constraints, and cost/benefit analysis
- Document the potential problems that were identified and associated contingency plans
- Develop support and training plan for users impacted by upgrade

### **Deliverables:**

- Report defining current situation, recommended changes, and impact of upgrade to current operations
- Documentation of research on vendors and products (who and what was researched? what information was obtained and analyzed?)
- Presentation defining upgrade recommendations based on research completed
- Report of identified problems and proposed solutions
- Report outlining training and support plan for users
- Brief report on how the team was organized, what role each team member played, and how effective the team process was during the activity

### **Suggested Assessments:**

- Review reports and documentation for organization, accuracy and clarity of communication
- Evaluate research process for thoroughness and relevance
- Evaluate report outlining training and support plan for users for completeness, clarity, and ease of use
- Evaluate presentation for thoroughness, clarity and persuasiveness
- Evaluate presentation to determine whether appropriate recommendations were made based on research completed
- Review report on potential problems and contingency plan for thoroughness and creativity of solutions
- Review team report for effectiveness of the team process

## **Primary Program Outcomes Addressed by Activity:**

### *Business Organization and Environment*

- Identify and work within an organization's environmental dynamics and constraints

### *Communication (Verbal and Written)*

- Evaluate and select the appropriate written and oral communication strategies and styles for a specific purpose

### *Customer Relations*

- Identify and meet the needs of the customer and the business

### *Design*

- Evaluate product design, document the specifications, create and test a prototype

### *Operational Impact*

- Communicate technology changes to customers and assess the impact on productivity

### *Problem Solving and Analytical Thinking*

- Select, implement, and evaluate appropriate problem-solving techniques and tools

### *Requirement Analysis*

- Gather, analyze and document information from relevant sources to develop requirements
- Create, refine and document requirements and present to stakeholders for approval

### *Research*

- Effectively communicate and present research results
- Organize, analyze, and synthesize results of research

### *Technical Documentation*

- Create effective technical documentation appropriate to various audiences and purposes

### *Network Architecture*

- Gather, analyze, and document customer requirements and organizational constraints as they relate to network architecture

### *Network Hardware Components*

- Compare features and functions of components

### *Network Software Applications*

- Analyze needs of organization and research vendors to identify and obtain appropriate software applications
- Install, configure, upgrade, and document network software applications and recommend

### *Network Testing and Troubleshooting*

- Document source of malfunction and solutions implemented

*Network Upgrade*

- Develop and implement an upgrade plan that meets organizational needs
- Analyze current system and organization requirements to identify system upgrade requirements

*Network Vendors and Products*

- Research, select and document vendors, products and services that meet organizational, user and technical support needs

## Activity 3 -- Network Operations

Working as a team, students will create a daily routine for a systems administrator, addressing the following areas:

- Network management
- Protection/Security
- Documentation
- Backup procedures
- Organization of resources
- Set up/tune-up of network

### Tasks:

- As a team, organize the work, develop a schedule for completion of tasks and assign tasks to each member
- Interview a current professional system administrator (either as a team or individually)
- Conduct research using the Internet and manufacturer specifications
- For each of the areas identified above, develop a two to five page step-by-step procedure for addressing each of the areas
- As a team, organize and compile a report including all the contributions from the different team members
- Choose one or two areas, and develop and deliver a team presentation detailing what steps are necessary
- Document the team process and organization of the project

### Deliverables:

- Project scope, task schedule and assignment
- Notes from interview with professional system administrator
- Report on result of Internet research
- Report of step-by-step procedure/daily routine that will encompass all areas identified
- Detailed presentation to the class outlining one area
- Documentation of team and project organization process

### Suggested Assessments for Teacher:

- Evaluate project organization for effectiveness and thoroughness
- Review interview results for completeness and relevance
- Ask feedback from interviewees on student professionalism and communication skills
- Evaluate thoroughness and relevance of research
- Evaluate completeness, accuracy and ease-of-use of procedures
- Evaluate presentations for organization, completeness and visual interest
- Evaluate team process throughout the project

### Primary Program Outcomes Addressed by Activity:

*Communication (Verbal and Written)*

- Develop and deliver effective oral communications
- Evaluate and select the appropriate written and oral communication strategies and styles for a specific purpose

### *Problem Solving and Analytical Thinking*

- Apply analytical thinking to gathering information, designing and testing solutions to a problem, and formulating plans

### *Research*

- Effectively communicate and present research results
- Organize, analyze, and synthesize results of research
- Develop and implement an effective process to gather research data from a variety of sources

### *Team Process and Leadership*

- Work effectively within the team's dynamics to support and further team goals
- Promote and contribute to a team process that supports diversity

### *Technical Documentation*

- Apply appropriate techniques, standards, processes and tools to develop and revise technical documentation
- Create effective technical documentation appropriate to various audiences and purposes

### *Network Administration*

- Maintain and document administrative procedures for security, resource access, and backup
- Make recommendations and follow procedures for network resource allocation and access, backup and security

### *Network Hardware Components*

- Compare features and functions of components

### *Network Maintenance*

- Develop and implement an effective network maintenance plan and schedule

### *Network Monitoring and Optimization*

- Select and effectively apply system monitoring and optimization tools and methods
- Establish and document baseline performance and make recommendations to management for system optimization

### *Network Operations*

- Evaluate and document network system performance
- Analyze and troubleshoot network problems

### *Network Recovery*

- Develop and document disaster recovery-plan procedures and train users
- Develop and implement network disaster control, recovery and backup procedures with minimal impact to users
- Make recommendations for disaster recovery procedures and strategies

### *Network Security*

- Analyze and apply security policies, requirements, procedures, and tools
- Identify, document, and report security risks to network and make recommendations for security improvement

### *Network Software Applications*

- Monitor and document software performance, troubleshoot software malfunctions and test functionality

### *Network Terminology and Concepts*

- Apply concepts and terminology to solve problems in networking

### *Network Testing and Troubleshooting*

- Develop, document, and implement testing and troubleshooting procedures in accordance with organization requirements
- Document source of malfunction and solutions implemented

### *Network Vendors and Products*

- Research, select and document vendors, products and services that meet organizational, user and technical support needs

### *Office Software Applications*

- Use software applications to analyze and solve business problems, and enhance productivity
- Use software applications to effectively support the business communication process

## Activity 4 -- Network Software Applications

Students will be given a set of requirements/specifications for:

- Network print server
- Printer drivers
- Individual users
- Groups of users
- Rights/permissions for each group
- Applications (DOS, Windows applications, etc)

### **The students will then:**

- Develop and document proposed procedure for installing the network printer
- Set up and install network printer (and appropriate drivers) on appropriate user machines
- Troubleshoot problems with print server or workstation access, given either real situations or written scenarios; identify possible trouble areas and solutions (using vendor websites, product documentation, Usenet groups, etc)
- Revise installation and troubleshooting procedure based on experience, including the documentation of potential problems and possible solutions

### **Deliverables:**

- Proposed procedure for setting up/installing printer and driver(s)
- Report documenting problems that were identified, step-by-step procedures that were used to identify cause and test possible solutions, and solutions that were implemented
- Recommendation report for installation and troubleshooting

### **Suggested Assessments:**

- Evaluate clarity and accuracy of procedure
- Evaluate problem/solution document to determine use of effective problem-solving process
- Evaluate recommendation report for appropriateness, creativity and thoroughness

### **Primary Program Outcomes Addressed by Activity:**

#### *Communication (Verbal and Written)*

- Create and adapt effective written communications according to audience and purpose
- Evaluate & select appropriate written/oral communication strategies/styles for specific purposes

#### *Customer Relations*

- Gather and interpret information to understand customer requirements
- Effectively communicate and interact with customers
- Identify and meet the needs of the customer and the business

#### *Operational Impact*

- Communicate technology changes to customers and assess the impact on productivity

#### *Problem Solving and Analytical Thinking*

- Apply analytical thinking to gathering information, designing & testing solutions to a problem and formulating plans

- Create, test and document resolution processes and solutions
- Select, implement, and evaluate appropriate problem-solving techniques and tools

#### *Requirement Analysis*

- Gather, analyze and document information from relevant sources to develop requirements
- Create, refine and document requirements and present to stakeholders for approval

#### *Team Process and Leadership*

- Select and apply a leadership style that is most effective for the team and the environment
- Work effectively within the team's dynamics to support and further team goals
- Promote and contribute to a team process that supports diversity

#### *Technical Documentation*

- Apply appropriate techniques, standards, processes and tools to develop and revise technical documentation
- Create effective technical documentation appropriate to various audiences and purposes

#### *Network Configuration*

- Research client configuration needs, develop a proposed network configuration and present recommendations
- Implement a proposed configuration plan and test network after implementation
- Compare various configuration strategies to determine appropriate plan for organization and user requirements

#### *Network Hardware Components*

- Select and install network components according to system requirements and constraints

#### *Network Installation*

- Test and troubleshoot performance of network components during and after installation
- Plan and document component and network installation

#### *Network Operations*

- Analyze and troubleshoot network problems

#### *Network Terminology and Concepts*

- Apply concepts and terminology to solve problems in networking

#### *Network Testing and Troubleshooting*

- Select & use diagnostic tools and equipment to identify & analyze network malfunctions
- Develop, document & implement testing and troubleshooting procedures in accordance with organization requirements
- Document source of malfunction and solutions implemented

#### *Office Software Applications*

- Use software applications to analyze & solve business problems, and enhance productivity
- Use software applications to effectively support the business communication process

## Activity 5-- Network Vendors and Products

Given a specific set of hardware and software requirements and network design, and specific budgetary and technology constraints, students will develop a buying list for the requested products

### **The students will:**

- Develop a set of questions and a process to qualify vendors and products
- Investigate potential vendors/suppliers and products
- Conduct research and analyze results
- Develop options for specific vendors and products with associated cost/benefit analysis
- Assess reliability of equipment and level of vendor support
- Determine availability of products given required timeline
- Develop presentation to management on recommended vendors/products with supporting justification and estimated total budget

### **Deliverables:**

- Documentation of research process and questions
- Report documenting research results and analysis
- Presentation to class outlining all options with cost/benefit analysis
- Presentation to class on chosen vendors/products with justifications supporting choice(s)

### **Suggested Assessments for Teacher:**

- Evaluate thoroughness and relevance of research
- Evaluate research documentation for organization and completeness
- Evaluate the effectiveness of analysis of the research information and appropriateness of choices made during and after the research
- Evaluate effectiveness of presentation in presenting key information and recommendations
- Evaluate the validity and thoroughness of justifications supporting the recommendations

### **Primary Program Outcomes Addressed by Activity:**

#### *Business Organization and Environment*

- Identify and work within an organization's environmental dynamics and constraints

#### *Communication (Verbal and Written)*

- Develop and deliver effective oral communications
- Create and adapt effective written communications according to audience and purpose
- Evaluate and select the appropriate written and oral communication strategies and styles for a specific purpose

#### *Operational Impact*

- Communicate technology changes to customers and assess the impact on productivity
- Analyze operational and budgetary impact of technology changes

#### *Project Planning and Organization*

- Efficiently organize and monitor project resources and tasks to meet requirements
- Develop a complete and realistic project plan that meets the requirements identified by stakeholders

### *Requirement Analysis*

- Gather, analyze and document information from relevant sources to develop requirements
- Create, refine and document requirements and present to stakeholders for approval

### *Research*

- Effectively communicate and present research results
- Organize, analyze, and synthesize results of research
- Develop and implement an effective process to gather research data from a variety of sources

### *Network Hardware Components*

- Compare features and functions of components

### *Network Installation*

- Plan and document component and network installation

### *Network Operating Systems*

- Present advantages, limitations, and preferred applications of various network operating systems

### *Network Software Applications*

- Analyze needs of organization and research vendors to identify and obtain appropriate software applications

### *Network Terminology and Concepts*

- Apply concepts and terminology to solve problems in networking

### *Network Upgrade*

- Analyze current system and organization requirements to identify system upgrade requirements

### *Network Vendors and Products*

- Evaluate and document strengths and limitations of specific vendors, products and services
- Research, select and document vendors, products and services that meet organizational, user and technical support needs

### *Office Software Applications*

- Use software applications to analyze and solve business problems, and enhance productivity
- Use software applications to effectively support the business communication process